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# Mini-Mental State Exam Status of Community-Dwelling Cognitively Intact Centenarians

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Mini-Mental State Exam (MMSE) scores for 247 community-dwelling, well-functioning individuals in their 60s (n = 88), in their 80s (n = 92), and 100 or older (n = 67) were compared to examine overall and component MMSE differences. The concomitant influences of visual or literacy deficits, gender, education, race, income, and activities of daily living on MMSE performance were analyzed. Mean MMSE scores of 27.8, 27.1, and 24.8, respectively, for the three cohorts were significantly different, even when all concomitant variables were controlled. After the concomitant variables were controlled, results indicated that there were no age group differences on five MMSE items: naming, repeating, listening and obeying, reading and obeying, and writing sentences. Participants with visual or literacy deficits scored 1.5 points lower than other partimcipants, and displayed performance deficits in four items form the Read & Write MMSE division: naming, reading and obeying, writing sentences, and praxis. Education and gender were significant covariates for total and divisional MMSE scores.

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# Mini-Mental State Exam Status of Community-Dwelling Cognitively Intact Centenarians

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ABSTRACT. Mini-Mental State Exam (MMSE) scores for 247 community-dwelling, well-functioning individuals in their 60s ($n = 88$), in their 80s ($n = 92$), and 100 or older ($n = 67$) were compared to examine overall and component MMSE differences. The concomitant influences of visual or literacy deficits, gender, education, race, income, and activities of daily living on MMSE performance were analyzed. Mean MMSE scores of 27.8, 27.1, and 24.8, respectively, for the three cohorts were significantly different, even when all concomitant variables were controlled. After the concomitant variables were controlled, results indicated that there were no age group differences on five MMSE items: naming, repeating, listening and obeying, reading and obeying, and writing sentences. Participants with visual or literacy deficits scored 1.5 points lower than other participants, and displayed performance deficits in four items from the Read & Write MMSE division: naming, reading and obeying, writing sentences, and praxis. Education and gender were significant covariates for total and divisional MMSE scores.

Relatively little is known about the mental status of centenarians and the oldest old. When the Mini-Mental State Exam (MMSE; Folstein et al., 1975) is used to assess the oldest old, scant data exist concerning the influence of concomitant variables such as sensorial or literacy deficits, which are frequently present in this population and may detract from optimal performance. This paucity may contribute to a tendency to relax or prorate these patients' total MMSE scores in clinical settings.

There are three primary sets of questions this article seeks to answer. First, what are performance norms on the MMSE for community-dwelling, well-functioning centenarians, and how do they compare and contrast with MMSE performances by cohorts who are in their 80s and 60s? Second, how are total and component MMSE scores affected by the sensorial impairments frequently

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encountered among the oldest old? Finally, are there items in the MMSE that are differentially sensitive to the potentially moderating concomitant influences of education, race, activities of daily living, gender, and socioeconomic status? Answers to these questions would provide empirical data to assist clinicians in deciding whether to prorate patients' MMSE scores because of possible performance impediments not necessarily reflective of underlying pathology.

Mental status is a multifactorial construct. It includes such processes as orientation, attention, consciousness, thought content, thought form, thinking processes, memory, language, general knowledge, constructional ability, abstraction, judgment, and insight. Poon and colleagues (1992b) have previously reported findings on the cognitive abilities of cognitively intact centenarians based upon their performances on four subtests of the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981), a paired associate learning task (Trahan et al., 1989), the Presidents' Test (Hamsher & Roberts, 1985), and a practical problem-solving measure (Denney & Palmer, 1981). Except for their anomalous finding on everyday problem-solving abilities, the widely disseminated finding of decremental cognitive performance as a function of advancing age was confirmed (Poon, 1985).

Are MMSE scores expected to be lower for community-dwelling and well-functioning centenarians simply because these persons are older? If so, are performance decrements due to underlying cognitive impairment or possibly due to peripheral deficits? The expectation that nondemented centenarians would display performance decrements on psychometric measures of cognitive abilities provides little guidance to clinicians who seek to differentially diagnose pathological abnormalities in cognitive functioning. The data we report help elucidate answers to these questions.

The MMSE is a brief bedside screening instrument to detect cognitive impairment in orientation to time and place, instantaneous recall, short-term memory, ability to perform serial subtractions or reverse spelling, constructional capacities, and the use of language (Folstein, 1983). The MMSE comprises 11 items that yield a maximal score of 30. The 11 items can be placed into two major divisions. The Vocal division (21 points) evaluates orientation, memory, and attention. The Read & Write division (9 points) evaluates naming, following spoken and written commands, sentence generation, and constructional abilities. The division assignment and maximal point contribution for all 11 items are contained in the tables.

Differential MMSE cutoff scores have been proposed for detecting probable cognitive impairment in select populations and environments, with the majority of proposed cutoff scores falling within the 22/23 to the 26/27 range (Anthony et al., 1982; Escobar et al., 1986; Regier et al., 1984), although a 22/23 cutoff has been reported as most closely balancing sensitivity (.87) and specificity (.82) for clinical purposes (Anthony et al., 1982).

No consensus has emerged in the MMSE literature on age, education, gender, race, culture, social class, or activities of daily living as moderating variables in MMSE performance (Anthony et al., 1982; Bassett & Folstein, 1991; Bird et al.,

1987; Bleecker et al., 1988; Folstein et al., 1985; Gurland et al., 1992; Holzer et al., 1984; Jorm et al., 1988; Murden et al., 1991; O'Connor et al., 1989; Salmon et al., 1989). In sum, the MMSE literature suggests the existence of a bivariate negative correlation between age and total MMSE scores, a positive bivariate correlation between educational attainment and total MMSE scores (Axelrod et al., 1992; Crum et al., 1993; Escobar et al., 1986), and no clear pattern of the relationships between gender, race, or activities of daily living with total MMSE scores, after controlling for the effects of age and education.

## METHOD

### Participants

Two hundred forty-seven participants in a multivariate, longitudinal study of aging, the Georgia Centenarian Study (Holtsberg & Pugh, 1994; Poon, 1992a), were included in this MMSE study. Participants were divided among three age groups: 88 people in their 60s, 92 people in their 80s, and 67 people 100 years old or older. The cohorts of those who were in their 60s and 80s were recruited through probability samples and mirror the gender and racial characteristics of their respective Georgia age groups. The centenarian cohort was recruited through aging agency networks, media, and referrals. The mean ages and standard deviations for each age group were 64.9 years (2.9), 82.6 years (2.3), and 100.7 years (1.4), respectively. Age verification was made for all participants. Forty-two percent of those in their 60s, 33% of those in their 80s, and 25% of those 100 or older were males. Approximately 27% of the total sample were African Americans. White Americans had more education, on average, than African Americans, with 70.1% of the Whites but 42.4% of the African Americans having completed high school. The three age groups differed in their educational levels, with 73.9% of those in their 60s, 58.7% of those in their 80s, and 53.7% of the centenarians having completed high school. Sixty-six percent of the women had completed high school, whereas 55.9% of the men had done so.

### Selection Criteria

All participants were required to fulfill two inclusion criteria. First, the participants were required to be community-dwelling as defined by their living in a semi-independent or independent environment. Individuals were not considered community-dwelling if they lived in a nursing home or rehabilitation center, but could be considered community-dwelling in a retirement home or similar setting. Second, individuals were required to be cognitively intact as evidenced by an MMSE attained score of 21 or higher. A 20/21 MMSE cutoff score was adopted to accommodate performance decrements attributable to cohort-unique confounds that would not necessarily indicate cognitive impairment. Additionally, the Global Deterioration Scale (Reisberg et al., 1982) was used to exclude participants judged to be at or below stage 3.

## Visual and Literacy Deficits

Sensorial, literacy, and other deficits that did not reflect cognitive impairment but that could moderate performance were noted by the testers. More centenarians displayed visual and literacy deficits that affected their MMSE performances. Five percent of the participants from the younger age groups (5 males, 4 females) had such deficits (8 literacy; 1 visual). In comparison, 30% of the centenarians (5 males, 15 females) had these problems. Twelve centenarians had visual deficits, 6 had literacy deficits, and 2 had both deficits. Auditory and motor deficits were not reported to have impaired MMSE performance for any participants. The mean MMSE score and standard deviation for all participants with visual or literacy deficits were 23.45 and 2.41, respectively.

## Procedure

The MMSE was administered in the traditional manner. All participants were tested individually. However, centenarians were tested in their own homes, and the two younger age groups were tested either in their homes or in community centers. Participants received the higher of the two scores on the Serial 7s or Spell "WORLD" Backwards tasks. Items participants refused to, or were unable to, perform were scored as "wrong." Other information such as education, gender, race, activities of daily living, and measures of socioeconomic status was obtained as part of the protocol.

# RESULTS

Three sets of analyses were employed to examine the effects on MMSE scores of (a) age group membership, (b) visual and literacy deficits, and (c) education, gender, race, income, instrumental activities of daily living, and physical activities of daily living. We examined these effects at three levels: total MMSE score, score in the Vocal and Read & Write divisions, and score for each of the 11 individual items. These analyses were performed to isolate item and component sensitivity within the MMSE to these three effect strata. All statistical analyses were made using SPSS-X or SPSS/PC+5.0 software.

## Age Group Differences and Effects of Visual and Literacy Deficits

Table 1 summarizes the mean MMSE performances of the three age groups and results of analyses of variance. The parentheses in Table 1 denote scores for all participants, while the brackets denote scores for only those participants without visual or literacy deficits.

In the comparison of MMSE scores for all participants across the three age groups, centenarians scored significantly lower (24.79 points) than the groups in their 80s (27.10 points) or 60s (27.78 points). When we eliminated all participants with visual and literacy deficits, scores for the remaining partici-

**TABLE 1. Analysis of Variance Results**

| MMSE Item (Maximum Points) | 60s vs. 80s (All Subjects) [Without Visual/ Literacy Deficits] | 60s vs. 100s (All Subjects) [Without Visual/ Literacy Deficits] | 80s vs. 100s (All Subjects) [Without Visual/ Literacy Deficits] | Significance ($F$ (2,244) ) [$F$ (2,215) ] |
|---|---|---|---|---|
| Total MMSE (30) | (27.78/27.10) [28.12/27.23]* | (27.78/24.79)* [28.12/25.30]* | (27.10/24.79)* [27.23/25.30]* | ($F$ = 34.134, $p$ = .0000) [$F$ = 28.592, $p$ = .0000] |
| Vocal (V) (21) | (19.19/18.68) [19.45/18.75]* | (19.19/17.12)* [19.45/17.17]* | (18.68/17.12)* [18.75/17.17]* | ($F$ = 21.834, $p$ = .0000) [$F$ = 25.006, $p$ = .0000] |
| Read & write (R) (9) | (8.59/8.41) [8.67/8.48] | (8.59/7.67)* [8.67/8.12]* | (8.41/7.67)* [8.48/8.12]* | ($F$ = 19.695, $p$ = .0000) [$F$ = 8.824, $p$ = .0002] |
| Orientation—time (V) (5) | (4.83/4.89) [4.84/4.89] | (4.83/4.57)* [4.84/4.66] | (4.89/4.57)* [4.89/4.66]* | ($F$ = 9.598, $p$ = .0001) [$F$ = 4.372, $p$ = .0138] |
| Orientation—place (V) (5) | (4.92/4.92) [4.94/4.92] | (4.92/4.55)* [4.94/4.57]* | (4.92/4.55)* [4.92/4.57]* | ($F$ = 17.931, $p$ = .0000) [$F$ = 15.389, $p$ = .0000] |
| Registration (V) (3) | (3.0/2.92) [3.0/2.93] | (3.0/2.75)* [3.0/2.77]* | (2.92/2.75)* [2.93/2.77]* | ($F$ = 9.845, $p$ = .0001) [$F$ = 8.904, $p$ = .0002] |
| Attention/calculation (V) (5) | (4.25/4.24) [4.45/4.26] | (4.25/3.87) [4.45/3.81]* | (4.24/3.87) [4.26/3.81] | (*ns*) [$F$ = 4.993, $p$ = .0076] |
| Recall (V) (3) | (2.19/1.71)* [2.22/1.75]* | (2.19/1.39)* [2.22/1.36]* | (1.71/1.39) [1.75/1.36] | ($F$ = 13.394, $p$ = .0000) [$F$ = 12.531, $p$ = .0000] |
| Naming (R) (2) | (2.0/2.0) [2.0/2.0] | (2.0/1.94) [2.0/2.0] | (2.0/1.94) [2.0/2.0] | (*ns*) [*ns*] |
| Repeat (R) (1) | (.97/.91) [.99/.92] | (.97/.90) [.99/.91] | (.91/.90) [.92/.91] | (*ns*) [*ns*] |
| Listen & obey (R) (3) | (2.90/2.88) [2.89/2.88] | (2.90/2.79) [2.89/2.81] | (2.88/2.79) [2.88/2.81] | (*ns*) [*ns*] |
| Read & obey (R) (1) | (.97/.97) [.99/.99] | (.97/.85)* [.99/.98] | (.97/.85)* [.99/.98] | ($F$ = 5.596, $p$ = .0042) [*ns*] |
| Write sentence (R) (1) | (.94/.97) [.96/.98] | (.94/.81)* [.96/.94] | (.97/.81)* [.98/.94] | ($F$ = 7.543, $p$ = .0007) [*ns*] |
| Praxis (R) (1) | (.82/.68) [.84/.72] | (.82/.39)* [.84/.49]* | (.68/.39)* [.72/.49]* | ($F$ = 17.970, $p$ = .0000) [$F$ = 9.956, $p$ = .0001] |

*Note.* MMSE = Mini-Mental State Examination; (V) = Vocal; (R) = Read & write.
* Significant. *ns* = not significant.

pants improved, as expected. However, the significant age group differences remained.

Table 1 depicts 14 univariate analyses of variance, with Tukey adjustments for multiple post hoc comparisons, for total MMSE, 2 MMSE divisions, and all 11 MMSE items. Eight of the 14 analyses reflect significant age group differences that are not eliminated by excluding participants with visual or literacy deficits. These measures are total MMSE, both the Vocal and Read & Write divisions, and the orientation to time, orientation to place, registration, recall, and praxis items.

Centenarians performed approximately as well as the other two age groups on three components (naming, repeating, and listening and obeying), results that remained invariant to the inclusion and exclusion of the participants with literacy or visual deficits. Two components (reading and obeying, and writing sentences) reflected significant group differences when all participants were included; however, the centenarians performed nearly as well as the other

**TABLE 2. Analysis of Variance Results Within Centenarian Cohort**

| MMSE Item (Maximum Points) | Subjects Without Visual/ Literacy Deficits | Subjects With Visual/ Literacy Deficits | Significance |
|---|---|---|---|
| Total MMSE (30) | 25.30* | 23.60* | $F = 6.7646$, $p = .0115$ |
| Vocal (V) (21) | 17.17 | 17.00 | *ns* |
| Read & write (R) (9) | 8.12* | 6.60* | $F = 30.3886$, $p = .0000$ |
| Orientation—time (V) (5) | 4.66 | 4.35 | *ns* |
| Orientation—place (V) (5) | 4.57 | 4.50 | *ns* |
| Registration (V) (3) | 2.77 | 2.70 | *ns* |
| Attention/calculation (V) (5) | 3.81 | 4.00 | *ns* |
| Recall (V) (3) | 1.36 | 1.45 | *ns* |
| Naming (R) (2) | 2.00* | 1.80* | $F = 5.0663$, $p = .0278$ |
| Repeat (R) (1) | .91 | .85 | *ns* |
| Listen & obey (R) (3) | 2.81 | 2.75 | *ns* |
| Read & obey (R) (1) | .98* | .55* | $F = 28.2722$, $p = .0000$ |
| Write sentence (R) (1) | .94* | .50* | $F = 22.2183$, $p = .0000$ |
| Praxis (R) (1) | .49* | .15* | $F = 7.3471$, $p = .0086$ |

*Note.* MMSE = Mini-Mental State Examination; (V) = Vocal; (R) = Read & write.
* Significant, $F$ (1, 65). *ns* = not significant.

groups when participants with visual and literacy deficits were excluded. Significant group differences emerged for attention/calculation only when participants with visual or literacy deficits were excluded. These findings suggest that MMSE components reflect differential sensitivity to participants with visual or literacy deficits. In summary, centenarians without literacy or visual deficits could perform about as well as the other groups for 5 of the 11 MMSE items.

## Effects of Visual and Literacy Deficits on Centenarians' MMSE Scores

Table 2 depicts the comparison of centenarians' scores for subjects with and without visual or literacy deficits. As expected, participants without these problems scored significantly higher, by approximately 1.5 points. As expected, scores on items that were entirely dependent upon the ability to read, to see, or both (naming, reading and obeying, writing sentences, and praxis) and were contained in the Read & Write division were significantly lower for those participants with such deficits. No differences were found for those items that do not require visual or reading skills (e.g., items in the Vocal division). Consistent with this observation, Read & Write divisional scores, but not Vocal scores, differed significantly between the two subsets of centenarians.

## Effects of Concomitant Variables on MMSE Scores

The relative influences of education, gender, race, activities of daily living, and economic status on MMSE overall and component scores are summarized in Table 3. These concomitant variables are used as covariates in three sets of analysis of variance: (a) age group effects for all participants, (b) age group

**TABLE 3. Covariate Results**

| MMSE Item (Maximum Points) | All Subjects $F$ (1,238), $p < .05$ | Subjects Without Visual/Literacy Deficits $F$ (1,209), $p < .05$ | Centenarians With Visual/Literacy Deficits Versus Those Without $F$ (1, 59), $p < .05$ |
|---|---|---|---|
| Total MMSE (30) | E ($F$ = 44.927)<br>G ($F$ = 17.227)<br>R ($F$ = 4.983) | E ($F$ = 37.711)<br>G ($F$ = 18.632) | *ns* |
| Vocal (V) (21) | E ($F$ = 32.200)<br>G ($F$ = 11.998) | E ($F$ = 30.569)<br>G ($F$ = 15.027) | *ns* |
| Read & write (R) (9) | E ($F$ = 12.375)<br>G ($F$ = 5.185) | E ($F$ = 10.885)<br>G ($F$ = 5.485) | *ns* |
| Orientation—time (V) (5) | *ns* | *ns* | *ns* |
| Orientation—place (V) (5) | PADL ($F$ = 6.329) | PADL ($F$ = 7.397) | PADL ($F$ = 5.101) |
| Registration (V) (3) | G ($F$ = 5.201) | IADL ($F$ = 4.417) | G ($F$ = 5.014) |
| Attention/calculation (V) (5) | E ($F$ = 45.614)<br>G ($F$ = 6.650)<br>R ($F$ = 4.983)<br>PADL ($F$ = 4.149) | E ($F$ = 31.362)<br>G ($F$ = 7.722) | E ($F$ = 11.469) |
| Recall (V) (3) | *ns* | G ($F$ = 4.498)<br>I ($F$ = 4.870) | *ns* |
| Naming (R) (2) | *ns* | *ns* | *ns* |
| Repeat (R) (1) | IADL ($F$ = 5.749)<br>PADL ($F$ = 5.850) | *ns* | PADL ($F$ = 4.020) |
| Listen & obey (R) (3) | *ns* | E ($F$ = 4.262)<br>G ($F$ = 5.335) | *ns* |
| Read & obey (R) (1) | *ns* | *ns* | *ns* |
| Write sentence (R) (1) | E ($F$ = 4.504)<br>G ($F$ = 4.448)<br>IADL ($F$ = 4.588)<br>PADL ($F$ = 3.881) | G ($F$ = 5.211)<br>IADL ($F$ = 23.316)<br>PADL ($F$ = 4.561) | IADL ($F$ = 9.099) |
| Praxis (R) (1) | E ($F$ = 10.281)<br>R ($F$ = 6.143)<br>IADL ($F$ = 4.273) | E ($F$ = 6.441)<br>R ($F$ = 6.594) | *ns* |

*Note.* MMSE = Mini-Mental State Examination; (V) = Vocal; (R) = Read & write; E = education; G = gender; IADL = instrumental activities of daily living; I = income; *ns* = no significant covariates; PADL = physical activities of daily living; R = race.

effects for those participants without visual or literacy deficits, and (c) comparisons of centenarians with and without visual or literacy deficits.

The pattern of significant covariates reported in Table 3 was analyzed both in terms of frequency and in terms of magnitude of effect. Theoretically, each covariate could independently emerge as significant in each of the 52 analyses reported in Table 3. The actual frequency of occurrences was: gender—14; education—13; physical activities of daily living (PADL)—8; instrumental activities of daily living (IADL)—6; race—4; and income—1. Gender and education were observed to be important covariates at total, both divisions, and item MMSE levels. In contrast, IADL and PADL tended to be important only for select MMSE items in the Read & Write division. In our sample, men tended to score lower than women even when age group and educational levels were controlled. As expected, education was positively related to overall MMSE

scores, and was a significant covariate on MMSE items especially dependent on reading and writing skills. It would appear that the MMSE is relatively insensitive to the influence of activities of daily living, as well as to racial and economic differences, at least in this sample of participants.

The average estimated effect sizes for the covariates were computed in each instance where they were significant. Given an instance where a covariate was found to be significant, the average effect size for that covariate, $\eta^2$, was .074 for education; .044 for IADL; .032 for PADL; .031 for gender; .020 for income; and .018 for race.

## DISCUSSION

The study's inclusion, recruitment, and testing procedures qualify the results in three ways. First, the results may be generalizable only to community-dwelling and well-functioning oldest old. Second, the MMSE cutoff score may have differentially excluded a larger number of centenarians than both younger cohorts. Third, the magnitude of MMSE score differences between the centenarians and the two younger cohorts may be underestimated due to residential versus remote testing sites (Ward et al., 1990). Further, these results are subject to the same limiting caveat applicable to all cross-sectional designs, including the findings to be reported herein: Namely, it is not possible to infer that interindividual differences observed between cohorts of differing ages are reflective of intraindividual change (i.e., age-related changes) or are due to cohort or other effects (Schulz & Ewen, 1988).

This article addressed three topics concerning MMSE performance by the oldest old: (a) How do community-dwelling and cognitively intact centenarians' performances compare with those of older adults in their 60s and 80s? (b) How do the frequently encountered deficits in literacy or vision affect the oldest old's MMSE performance? (c) How do individual differences in education, gender, race, income, and activities of daily living affect MMSE performance?

The centenarians performed significantly worse on the MMSE compared to both younger age groups, even when participants with visual or literacy deficits were excluded from analysis. The age group differences are consistent with the differences in cognitive functioning typically reported in the cognitive aging literature (Poon, 1985), especially for measures of intelligence and memory (Poon et al., 1992b). Nevertheless, clinicians should not expect impaired MMSE performance by all centenarians. Fully one half of this centenarian sample achieved MMSE scores of 25 or higher, despite the visual or literacy deficits faced by some of these expert survivors.

On average, centenarians with visual or literacy deficits scored about 1.5 points lower than participants without such problems. Moreover, the point differential was manifested in four items—naming, reading and obeying, writing sentences, and praxis—each of which was a component of the Read & Write division. These deficits have no effect on the Vocal division, which accounts for 21 of the MMSE's 30 points. Therefore, clinicians who use the

MMSE to assess oldest-old patients with literacy or visual deficits should examine relative performances on the Read & Write and Vocal divisions. If performance decrements are concentrated in the Read & Write division only, clinicians may consider prorating MMSE scores in the Read & Write division by as much as 1.5 points to allow for the influence of these deficits. The results do not support proration of any points for items in the Vocal division.

Three conclusions may be drawn concerning the influences of education, race, gender, income, and activities of daily living on MMSE performance. First, the influences of the covariates were modest, both in terms of frequencies of occurrence and in average effect sizes. Significant age group effects remained at the total and divisional MMSE levels notwithstanding the covariates' influence. Second, the pattern of influences for these concomitant variables suggests one of a subtle item-by-item nature. This interpretation is consonant with the checkered pattern evident in the MMSE literature for the influence of race, socioeconomic status, gender, education, and activities of daily living, individually and collectively (Anthony et al., 1982; Bassett & Folstein, 1991; Bird et al., 1987; Bleecker et al., 1988; Folstein et al., 1985; Gurland et al., 1992; Holzer et al., 1984; Jorm et al., 1988; Murden et al., 1991; O'Connor et al., 1989; Salmon et al., 1989). Even so, the covariate of education was found significant in functions where reading skills were important. Third, income and race were not important covariates in MMSE performance. Clinicians should consider avoiding proration of patients' MMSE scores predicated solely upon these concomitant factors. Additional research to evaluate the influence of these concomitant variables at the MMSE divisional and item levels would be of assistance to clinicians.

Because normative data for the MMSE in centenarians are scant, these data may be a useful reference for clinicians faced with the assessment of the oldest old for possible dementia. These data suggest that substantial reductions in total scores should not be presumed or anticipated solely as a function of advanced age and the sensorial impairments that often accompany it.

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